CLAIMS

1. A radial vane for a toothbrush, the vane being in a disk-shape having a through hole at a center part thereof, through which a tip portion of a handle of the toothbrush penetrates; a weld portion in an annular shape provided around the through hole; and a plurality of bristle members extending outward from the weld portion in a radial direction of the disk shape, characterized in that

the weld portion includes a protrusion integrally formed on one or both of surfaces thereof.

2. The radial vane for the toothbrush according to claim 1, wherein the protrusion is an annular protrusion continuing in a circumferential direction.

3. The radial vane for the toothbrush according to claim 1, wherein the protrusion is formed as a group of protrusions formed interspacially along a circumferential direction.

4. The radial vane for the toothbrush according to claim 1, wherein the plurality of bristle members, extending outward from the annular weld portion in the radial direction of the disk shape, constitute a brush

portion where long bristle members and short bristle members are mixed.

5. The radial vane for the toothbrush according to claim 1, wherein the plurality of bristle members, extending outward from the annular weld portion in the radial direction of the disk shape, constitute a brush portion where bristle members having a large diameter and bristle members having a small diameter are mixed.

6. A 360-degree toothbrush characterized in that a radial brush head in a cylindrical shape, constituted by superposing a plurality of radial vanes according to one of claims 1 to 5, is disposed at a tip portion of a handle of the toothbrush.

7. The 360-degree toothbrush according to claim 6, wherein the plurality of radial vanes that constitute the radial brush head include a hard radial vane having bristles of a large diameter and a soft annular vane having bristles of a small diameter mixed therein.

8. The 360-degree toothbrush according to claim 6, wherein the plurality of radial vanes that constitute the radial brush head include a radial vane of a large diameter

having a long bristle length at a brush portion and a radial vane of a small diameter having a short bristle length at the brush portion mixed therein.

9. A method of manufacturing a radial vane for a toothbrush, characterized by:

a feeding step in which a bristle bundle formed by bundling a plurality of bristle members is caused to penetrate from a back face side to a surface side of a processing bed so as to be exposed on the processing bed by a predetermined length;

an opening step in which an exposed part of the bristle bundle is opened radially on the surface of the processing bed to a periphery;

a welding step in which a center part of the bristle bundle opened radially is welded in an annular shape; and

a removing step in which an inside of the weld portion in the annular shape is removed, characterized in that

in the welding step, when the center of the bristle bundle opened radially is welded in the annular shape, a protrusion is formed at the same time on a surface of the weld portion.

10. A method of manufacturing a radial vane for a

toothbrush, characterized by:

a feeding step in which a bristle bundle formed by bundling a plurality of bristle members and caused to penetrate from a back face side to a surface side of a processing bed is exposed on the processing bed by a predetermined length;

an opening step in which an exposed part of the bristle bundle is opened radially on the surface of the processing bed to a periphery; and

a welding and removing step in which a center part of the bristle bundle opened radially is pressed against the processing bed by a welding head in a cylindrical shape also serving as a punch so as to be welded in an annular shape, and at the same time, an inside of the weld portion in the annular shape is removed.

11. The method of manufacturing the radial vane for the toothbrush according to claim 11, wherein an annular blade is provided around a through hole of the processing bed, and the inside of the weld portion in the annular shape is removed by the annular blade and by an inner peripheral part of the welding head.

12. The method of manufacturing the radial vane for the toothbrush according to claim 10, wherein an annular

recessed part or a plurality of recessed parts arranged interspatially in a peripheral direction are provided around a through hole of the processing bed, and the center part of the bristle bundle opened radially is welded in an annular shape, and at the same time, a protrusion is formed on a surface of the weld portion.

13. An apparatus for manufacturing a radial vane for a toothbrush, characterized by:

feeding means for exposing a bristle bundle, formed by bundling a plurality of bristle members and caused to penetrate from a back face side to a surface side of a processing bed, on the processing bed by a predetermined length;

opening means for opening an exposed part of the bristle bundle radially on the surface of the processing bed to a periphery; welding means for welding a center part of the bristle bundle, opened radially, in an annular shape; and

removing means for removing an inside of the weld portion in the annular shape, characterized in that

a recessed part formed in an annular shape or a plurality of recessed parts formed interspacially in a peripheral direction are provided around a through hole of the processing bed such that a melting material is flown

therein when welding.

14. An apparatus for manufacturing a radial vane for a toothbrush, characterized by:

feeding means for causing a bristle bundle formed by bundling a plurality of bristle members to penetrate from a back face side to a surface side of a processing bed and exposing it on the processing bed by a predetermined length;

opening means for opening an exposed part of the bristle bundle radially on the surface of the processing bed to a periphery; and

welding and removing means for pressing a center part of the bristle bundle opened radially against the processing bed by a welding head in a cylindrical shape also serving as a punch so as to weld it in an annular shape, and at the same time, removing an inside of the weld portion in an annular shape.

15. The apparatus for manufacturing the radial vane for the toothbrush according to claim 14, comprising an annular blade, provided around a through hole of the processing bed, for removing an inside of the weld portion in the annular shape in cooperation with the welding head.

16. The apparatus for manufacturing the radial vane for the toothbrush according to claim 14, comprising a recessed part formed in an annular shape or a plurality of recessed parts arranged interspacially in a peripheral direction, provided around a through hole of the processing bed, such that a melting material is flown therein when welding.

17. The apparatus for manufacturing the radial vane for the toothbrush according to claim 14, wherein the welding head also serves as the opening means.

18. The apparatus for manufacturing the radial vane for the toothbrush according to claim 17, wherein the welding head has an exhaust hole for exhausting air at a center part thereof, and is capable of moving up and down, and with exhaust air, presses the bristle bundle opened to a periphery against the processing bed so as to fix it radially.